The Dative Illusion as an Argument for Lexicalist Argument Structure

Michael Wilson · University of Massachusetts Amherst
mawilson@linguist.umass.edu · blogs.umass.edu/michaelwilso

CLS 54, 04/26/2018

Goals and Roadmap

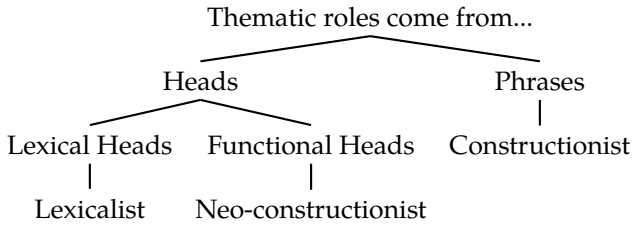
The two main questions I address in this presentation are the following:

- Where do thematic roles come from?
  - I show at least one domain where they must come from lexical heads.
- How can interpretive illusions arise?
  - I provide evidence that existing models of interpretive illusions are hard-pressed to account for, and suggest that the architecture of the grammar is relevant.

The presentation is organized as follows:

- §1 provides background about approaches to argument structure that differ in terms of where thematic roles come from.
- §2 provides background about the test case I'll use to distinguish between these different theories of argument structure: the English dative alternation.
- §§3 & 4 describe two experiments addressing the main questions above.
- §5 discusses how to account for the results of the experiments using a lexicalist theory of argument structure.

1. Approaches to Argument Structure



- Lexicalist: words' lexical entries specify the syntactic categories and associated semantic roles of each of their arguments (Müller & Wechsler 2014).

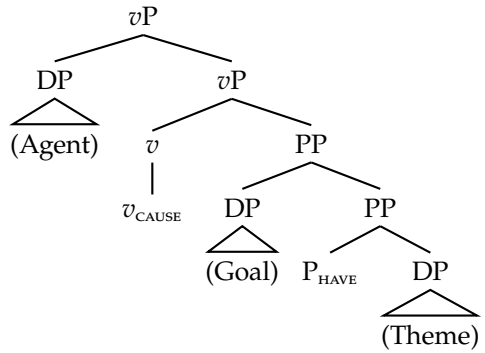
(1) a. *give*, DO: $\begin{bmatrix} \textsc{subcat} & \left\langle \text{DP}_x, \text{DP}\left[int.rec \right]_y, \text{DP}_z \right\rangle \\ \textsc{roles} & \left\langle \left[\textsc{ag} \left[x \right] \right], \left[\textsc{rec} \left[y \right] \right], \left[\textsc{th} \left[z \right] \right] \right\rangle \end{bmatrix}$

b. *give*, PD: $\begin{bmatrix} \textsc{subcat} & \left\langle \text{DP}_x, \text{DP}_z, \text{PP}\left[to \right]_y \right\rangle \\ \textsc{roles} & \left\langle \left[\textsc{ag} \left[x \right] \right], \left[\textsc{rec} \left[y \right] \right], \left[\textsc{th} \left[z \right] \right] \right\rangle \end{bmatrix}$

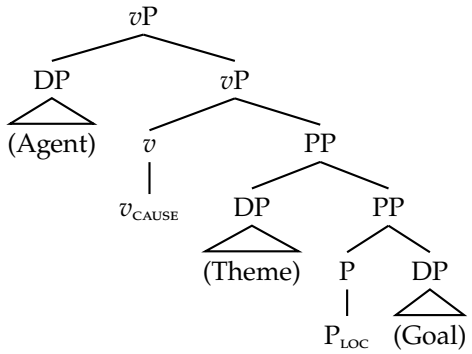
- Neo-Constructionist: DPs are interpreted differently depending on where they occur relative to functional heads in a verbal projection (Harley 1995, 2003, 2011).

θ-role		Position of DP
Agent	≈	Spec,*v*P
Theme	≈	Spec,SC ("Inner subject")
Goal	≈	Comp,SC
Incremental theme	≈	Comp,*v*P

(2) a. *give*, DO:

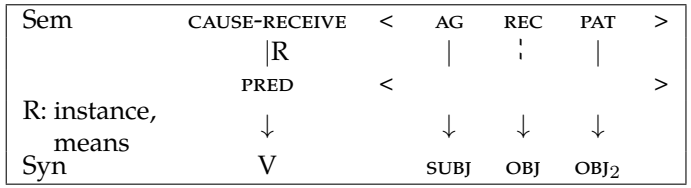


b. *give*, PD:

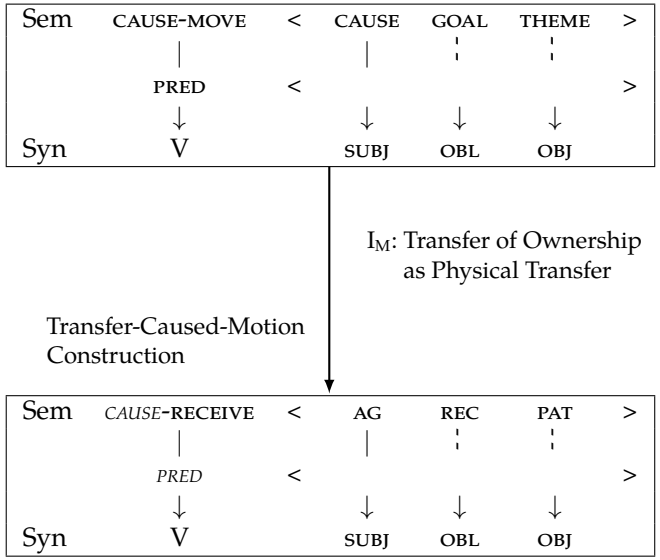


- Constructionist: DPs receive thematic roles based on where they occur in a construction, which contributes its own thematic roles (Goldberg 1995).

(3) a.



b.



2. Classes of Dative Verbs

Dative verbs display an asymmetry in the possible goal arguments they can take, which depends on the construction they occur in (Gropen et al. 1989; Krifka 1999, 2004; Pinker 2007; Rappaport Hovav & Levin 2007; Viau 2006):

(4) a. John sent a package to Bill. (= Prepositional Dative (PD))
b. John sent Bill a package. (= Double Object (DO) Dative)
c. John sent a package to London.
d. # John sent London a package.

- DO requires that the goal be a potential possessor of the theme.

(5) The Uniform Multiple Meaning Approach (e.g., Harley 2003):
   a. DO = "AGENT intends to cause GOAL to have THEME"
   b. PD = "AGENT causes THEME to { go to / be at } GOAL"

Rappaport Hovav & Levin (2007) provide evidence that verbs differ with respect to these meanings, against this analysis:

(6) The Verb-Sensitive Approach:
   a. # John gave a package to London.
   b. # John gave London a package.

Their verb-sensitive analysis:

	PD construction	DO construction
Give-type verbs	Caused Possession	
Send-type verbs	Caused Motion/Possession	Caused Possession

- *Give*-type verbs always require a possessor goal; *send*-type verbs only require possessor goals in the DO construction.

3. Experiment 1

Experiment 1 tests the predictions of the verb-sensitive approach in sentences with and without goal extraction.

- *Give*-type verbs with non-possessors should be unacceptable regardless of construction.
- *Send*-type verbs should be acceptable with non-possessors in the PD construction only.
- If these predictions are borne out, it provides support for an at least partially lexical approach to argument structure.
- But extraction makes coercion and integration of semantically anomalous material easier (Bredart & Modolo 1988; Ferreira et al. 2002; Ferreira & Patson 2007; Lowder & Gordon 2016; Sanford & Sturt 2002)

Are verb category effects robust enough that they show up in contexts where it is easy to integrate semantically anomalous material as well as where it is hard to do so?

3.1 *Materials*

20 sentences that crossed three two-level factors:

- Verb Type: *Give*-type/*Send*-type (Within subjects)
- Construction: DO/PD (Within subjects)
- Goal Extraction: Goal Extracted/Not Extracted (Between subjects)

(7) Non-Extracted goal:
Jane $\left\{\begin{matrix}\text{loaned}\\\text{threw}\end{matrix}\right\}$ $\left\{\begin{matrix}\text{the countertop some keys}\\\text{some keys to the countertop}\end{matrix}\right\}$.

(8) Extracted goal:
The countertop that Jane $\left\{\begin{matrix}\text{loaned}\\\text{threw}\end{matrix}\right\}$ some keys $\left\{\begin{matrix}\text{-}\\\text{to}\end{matrix}\right\}$ is all the way across the room.

3.2 *Methods*

- Sentences rated from 1 (implausible) to 7 (plausible)
- 48 MTurkers, paid $3.50, 8 per list, Latin Square design

3.3 *Results* (Plot & tables on next page)

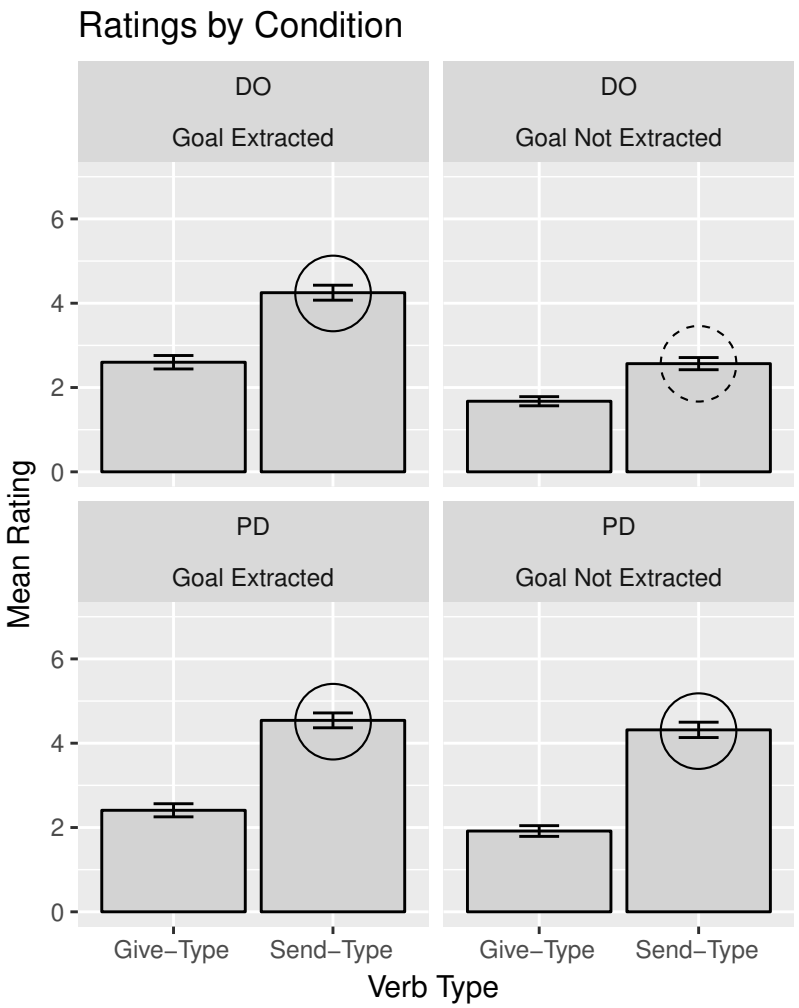
The key result is a three-way interaction between goal extraction, construction, and verb-type.

- *Send*-type verbs in the non-extracted goal condition are rated lower with non-possessor goals compared to *send*-type verbs in other conditions.
- The "dative illusion" is the fact that goal extraction results in higher ratings for these sentences, putting them on a par with *send*-type, PD sentences.

3.4 *Discussion*

These results support the verb-sensitive approach, at least for non-extracted goals:

- Running an ANOVA on the non-extracted goal cases separately shows a C × V interaction ($F_1 = 25.23$, $p < 0.05$; $F_2 = 27.39$, $p < 0.05$): ratings for *send*-type verbs are more different from those of *give*-type verbs in the PD sentences than in the DO sentences.



- In other words, *send*-type verbs get a bigger advantage over *give*-type verbs in the PD than in the DO case—presumably because this is when they can license a non-possessor goal.

- For sentences with extracted goals, the picture is more complicated, due to the dative illusion.

	Goal Extracted		Goal Not Extracted	
	Give-type	*Send*-type	*Give*-type	*Send*-type
DO	2.60	4.25	1.68	2.57
PD	2.41	4.54	1.92	4.32

Table 1: Mean Ratings per Condition (Exp. 1)

SV	*df*	F_1	Sig?
Goal Extraction (E)	46	16.28	$p < 0.05$
Construction (C)	46	21.22	$p < 0.05$
Verb Type (V)	46	197.26	$p < 0.05$
E × C	46	17.35	$p < 0.05$
E × V	46	0.95	--
C × V	46	28.78	$p < 0.05$
E × C × V	46	7.62	$p < 0.05$

Table 2: By Subjects ANOVA Results (Exp. 1)

SV	*df*	F_2	Sig?
E	19	28.97	$p < 0.05$
C	19	38.39	$p < 0.05$
V	19	61.55	$p < 0.05$
E × C	19	16.08	$p < 0.05$
E × V	19	1.28	--
C × V	19	27.39	$p < 0.05$
E × C × V	19	6.44	$p < 0.05$

Table 3: By Items ANOVA Results (Exp. 1)

How can interpretive illusions arise?

- These results are hard to explain with depth of processing (Bredart & Modolo 1988; Erickson & Mattson 1981; Sanford & Sturt 2002) or good-enough processing (Ferreira et al. 2002; Ferreira & Patson 2007) approaches.

  - Fine-grained lexical semantic information is being processed deeply enough to distinguish *give*- from *send*-type verbs. We could assume that lexical information is always processed while syntactic information is not (though this is not standard).

- Coercion being easier across clause boundaries (Lowder & Gordon 2016) also fails to account for the difference between *give*-type and *send*-type verbs, since coercion should occur with both.
- *The noisy channel model* (Gibson et al. 2013; Levy 2008; Levy et al. 2009): Participants are more likely to "correct" their interpretation of a sentence the more similar its form is to a plausible sentence.
- DO goal extractions are degraded for some speakers; maybe participants were "correcting" the sentence to PD goal extraction before rating. DO goal-extraction sentences with *send*-type verbs are very close to a plausible sentence: just insert *to*.

(9) The countertop that Jane threw some keys was all the way across the room.
→ The countertop that Jane threw some keys <u>to</u> was all the way across the room.

- DO sentences without goal extraction require reversing the order of DPs (less similar to a plausible sentence); sentences with *give*-type verbs require replacing the verb entirely (intuitively unlikely).

Where do thematic roles come from?

- The difference between *give*- and *send*-type verbs supports the verb-sensitive approach to the dative alternation. However, this approach could be made consistent with both lexicalist and neo-constructionist approaches to argument structure to these data, assuming the correction-based approach sketched above.
  - Lexicalist: *give*-type verbs always assign RECIPIENT; *send*-type verbs assign RECIPIENT in DO, and RECIPIENT or LOCATION in PD.
  - Neo-constructionist: *give*-type verbs may select either of two functional heads: P_{HAVE} (DO) and to_{POSS} (PD). *Send*-type verbs can select either P_{HAVE} (DO) or to_{LOC} (PD). Thematic restrictions are encoded indirectly in these functional heads, rather than in the lexical entries of the verbs themselves.
  - Participants can only correct a sentence by reinserting a preposition that can be selected by the verb; the difference in which prepositions each verb can select leads to the verb type differences. Reinserting to_{POSS} for *give*-type verbs won't fix the thematic role mismatch, and to_{LOC} isn't licensed by *give*-type verbs.

4. Experiment 2

Experiment 2 examined the dative illusion and its possible explanations in more detail. Its goals were the following:

- Determine whether dative illusion sentences behave the same way as sentences missing prepositions.
  - If sentences missing prepositions are corrected differently from dative illusion sentences, we would have evidence that the repair processes involved are different. In particular, differences would indicate that dative illusion sentences are not repaired by reinserting a preposition, which would argue against the neo-constructionist approach to exp. 1 sketched above.
- Determine whether correction can account for the dative illusion.
- Determine whether the dative illusion is the result of a conscious or an unconscious process.

4.1 Materials

- New manipulation: Strict vs. lenient instructions (between subjects):
  - Participants told to rate sentences either exactly as they were, or with leeway for typos and missing words.
  - If strict instructions → lower ratings for DO *send*-type goal extraction sentences, then the apparent dative illusion is a conscious correction.
  - If instructions produce no difference in ratings, the dative illusion is a true illusion, and occurs unconsciously.
- Restriction to four conditions of items (within subjects):
  - All verbs in exp. 2 were *send*-type, as these were the sentences showing the dative illusion effect.

$$\left\{\begin{matrix}\text{DO}\\\text{PD}\end{matrix}\right\} \times \left\{\begin{matrix}\text{Goal Extracted}\\\text{Goal Not Extracted}\end{matrix}\right\}$$

  - The dative illusion = interaction between construction and goal extraction on ratings: higher ratings for DO structures with extracted goals than for DO structures with non-extracted goals, no difference for PD structures.

- Goal Extraction was a within subjects factor unlike exp. 1.

(10) Non-extracted goal:
Jane threw { the countertop some keys / some keys to the countertop }.

(11) Extracted goal:
The countertop that Jane threw some keys { - / to } was all the way across the room.

- Well-Formed Fillers:
  - 32 (of 52) now coded as plausible/implausible to determine whether participants were using the scale as intended.
- Ill-formed Controls:
  - 5 items missing a preposition, 5 with plausible typos.
  - Designed to test whether dative items would behave the same with respect to instruction type as missing preposition items.
  - Presented in a block at the end of the main experiment.

(12) a. The train that Zack was waiting ~~*for*~~ was delayed due to an accident.
b. The new <u>care</u> that Chuck got at the dealership had expensive leather upholstery.

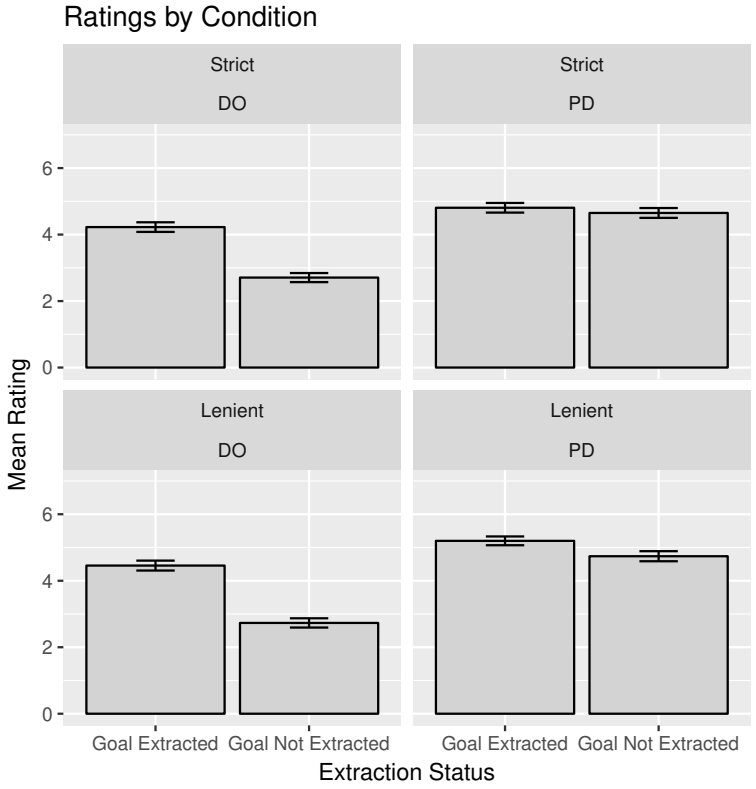
4.2 Methods

- Sentences were presented in two "chunks" that separated the subject and the predicate. The chunk break occured where the missing preposition would be. RTs were measured for each chunk, but won't be discussed today (nothing interesting shows up). Otherwise, the task was the same: rate sentences for plausibility.
- 64 MTurkers, paid $3.50, 32 in each instruction condition, 8 per list, Latin Square design

4.3 Results

4.3.1 Experimental Items

The key result is the interaction of Construction and Goal Extraction: this is the dative illusion. Also note the lack of an interaction of these with Instruction Type, as this will be relevant shortly.



Condition	DO		PD	
	Extracted	Not Extracted	Extracted	Not Extracted
Strict Instructions	4.23	2.71	4.81	4.65
Lenient Instructions	4.46	2.73	5.20	4.74

Table 4: Mean Ratings per Condition (Experimental items, Exp. 2)

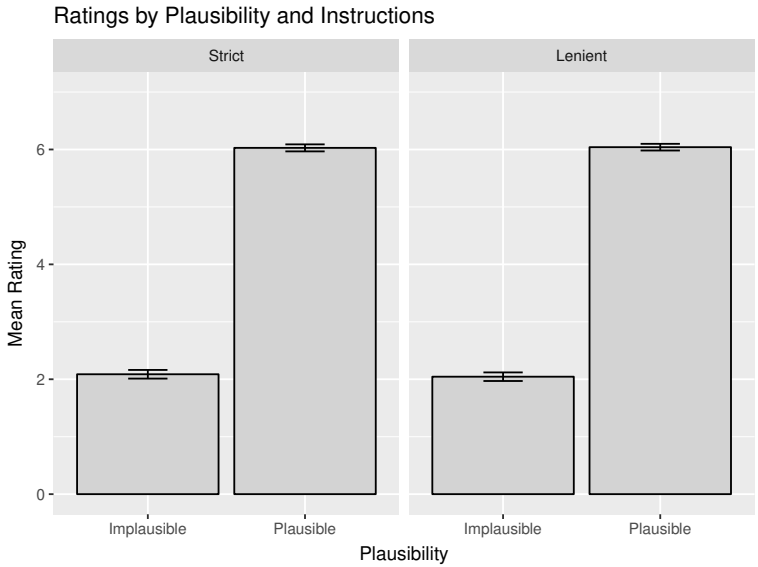
SV	*df*	F_1	Sig?
Construction (C)	1,62	153.03	$p < 0.05$
Goal Extraction (E)	1,62	62.21	$p < 0.05$
Instruction Type (IT)	1,62	1.16	--
C × E	1,62	60.26	$p < 0.05$
C × IT	1,62	0.28	--
E × IT	1,62	1.10	--
C × E × IT	1,62	0.09	--

Table 5: By Subjects ANOVA Results (Exp. 2)

SV	*df*	F_2	Sig?
C	1,19	105.80	$p < 0.05$
E	1,19	35.27	$p < 0.05$
IT	1,19	7.76	$p < 0.05$
C × E	1,19	27.36	$p < 0.05$
C × IT	1,19	0.29	--
E × IT	1,19	1.85	--
C × E × IT	1,19	0.08	--

Table 6: By Items ANOVA Results (Exp. 2)

4.3.2 *Well-Formed Fillers*



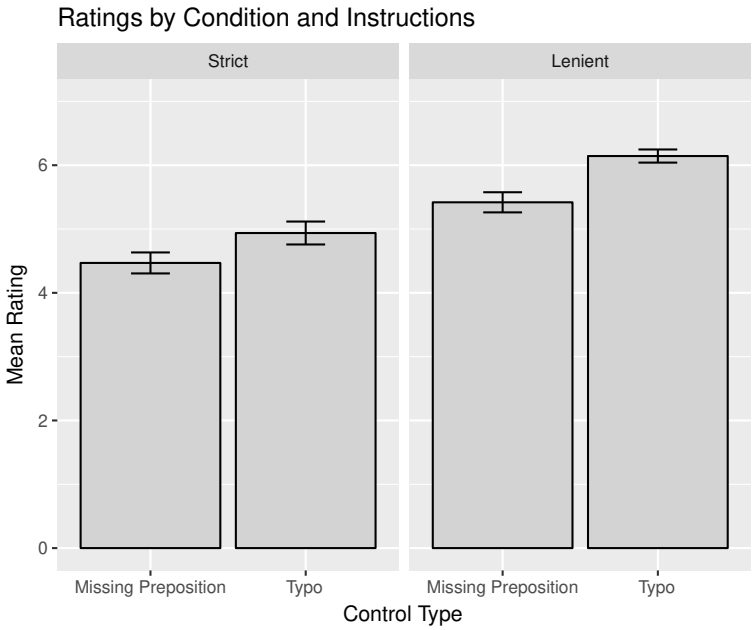
Condition	Strict	Lenient
Plausible	6.03	6.04
Implausible	2.09	2.04

Table 7: Mean Ratings per Condition (Fillers, Exp. 2)

Instructions had no effect on fillers: participants were interpreting them as intended.

- Participants were judging plausibility: plausible sentences were rated higher than implausible sentences ($F_1(1, 62) = 2239.84$, $p < 0.05$; $F_2(1, 30) = 146.19$, $p < 0.05$).

4.3.3 *Ill-formed Controls*



Condition	Strict	Lenient
Missing Preposition	4.47	5.42
Typo	4.94	6.14

Table 8: Mean Ratings per Condition (Controls, Exp. 2)

Participants rated controls higher when they saw lenient instructions ($F_1(1, 62) = 36.86$, $p < 0.05$; $F_2(1, 8) = 28.61$, $p < 0.05$).

4.3.4 *Summary*

- Ratings for well-formed fillers did not vary with instructions; this shows that participants were using the scale and interpreting instructions correctly. In particular, they weren't interpreting instructions as an invitation to just give better ratings to less plausible sentences in general.
- The dative illusion was replicated: participants rated DO sentences with goal extraction higher than DO sentences without goal extraction—despite the design changes between exps 1 and 2.
- Participants treated ill-formed controls differently depending on instructions, and did not do so for experimental items or well-formed fillers.

5. Discussion

How can interpretive illusions arise?

- Existing models of interpretive illusions are hard-pressed to explain the results of exp. 2:
  - Depth-of-processing and good-enough processing approaches fail to account for the difference between experimental items and ill-formed controls.
    - Four of five of the missing preposition fillers were missing the preposition in an object-relative clause; we would expect no difference between the experimental object-relatives and the ill-formed control object-relatives.
  - Ill-formed controls were as far from a plausible counterpart as the experimental items. Thus, the noisy channel model (Gibson et al. 2013; Levy 2008; Levy et al. 2009) also fails to account for this difference.
- A possible concern: order effects?
  - All ill-formed controls were presented in a row.
  - However, the effect of instruction type was significant by subjects at the first missing preposition item participants saw ($F_1(1, 62) = 4.66$, $p < 0.05$). Not significant by items, but this is presumably due to a lack of power by items when only considering one item.
  - Participants treat missing prepositions in experimental items and in ill-formed controls differently from the first time they see them. Repair mechanisms for ill-formed controls and experimental items are different.

Where do thematic roles come from?

- As repair mechanisms for experimental and missing preposition controls are different, we cannot assume that the dative illusion is the result of only being able to reinsert a preposition selected by particular types of verbs. These results thus support a lexicalist model of argument structure for dative verbs, where argument roles are contributed by the verb itself.
- In addition, these results point to a model of sentence processing where argument structure is assessed in combination with the lexical semantics of the verb.
    - If the verb allows an argument structure that would permit mapping the extracted goal to a plausible role, the dative illusion occurs.

An HPSG Account (left column adapted from Wechsler (1995)):

send, DO:

$$\begin{bmatrix} \textsc{subcat} & \langle \mathrm{DP}_x, \mathrm{DP}_z, \mathrm{DP}_y \rangle \\ \textsc{roles} & \left\langle \left[\textsc{ag}\left[x\right]\right], \left[\textsc{rec}\left[z\right]\right], \left[\textsc{th}\left[y\right]\right] \right\rangle \end{bmatrix}$$

send, PD:

$$\begin{bmatrix} \textsc{subcat} & \langle \mathrm{DP}_x, \mathrm{DP}_y, \mathrm{PP}_z \rangle \\ \textsc{roles} & \left\langle \left[\textsc{ag}\left[x\right]\right], \left[\textsc{th}\left[y\right]\right], \left[\textsc{goal}\left[z\right]\right] \right\rangle \end{bmatrix}$$

send, Illusory:

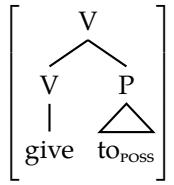
$$\begin{bmatrix} \textsc{subcat} & \langle \mathrm{DP}_x, \mathrm{DP}_z, \mathrm{DP}_y \rangle \\ \hdashline \textsc{roles} & \left\langle \left[\textsc{ag}\left[x\right]\right], \left[\textsc{th}\left[y\right]\right], \left[\textsc{goal}\left[z\right]\right] \right\rangle \end{bmatrix}$$

- Illusory *send* is a blend of DO and PD *send*.
- Allowing this non-lexically licensed mapping may be easier across clause boundaries, following the general pattern identified in Lowder & Gordon (2016).
- *Give*-type verbs always require a recipient rather than a goal, so there is no source that could result in the blend.

Alternative Approaches: Neo-Constructionist:

- The multiple *to*s approach to the dative illusion wouldn't account for why there's a difference between ill-formed controls and experimental items. A possible way around this would be to say that rather than PD *give* selecting $to_{\textsc{poss}}$, it "includes" it in a way that the missing preposition items don't:

(13)



    - This is essentially a lexicalist approach; we've just got a different notion of "word."
- We could also use a neo-constructionist style syntax with the thematic role being part of the denotation of *give*-type verbs. HPSG isn't required, though it makes it easier to visualize how the syntactic/semantic blending takes place in the illusory cases.
    - These approaches are all equivalent for my purposes: the thematic role is in whatever we mean by "the verb."

Constructionist:

- Assume we can derive a caused possession meaning from a caused motion construction; this is allowed via a metaphorical mapping "transfer of ownership as physical transfer" (Goldberg 1995).
    - We have to force this mapping for *give*-type verbs, even when there should be a plausible caused motion reading:

      (14) # John handed a book to the table.

    - We have to say some verbs only allow possessor goals—which is basically a lexical approach.

- Even assuming this, to account for the illusion would require positing that participants could derive a caused motion meaning from a caused possession construction—the opposite mapping. But again, this mapping could only be licensed for *send*-type verbs, since only they show the illusion. Lexically restricting the illusory process seems undesirable, as we're putting a processing fact into the grammar.

6. Conclusion

- Exp. 1 supports Rappaport Hovav & Levin (2007)'s verb-sensitive analysis of the dative alternation and for a lexical approach to argument structure. It also establishes the dative illusion as an illusion in the processing of argument structure.
- Exp. 2 shows that existing models of interpretive illusions fail to account for the dative illusion: we must appeal to argument structure to explain it.

Where do thematic roles come from?

- Exps. 1 & 2 taken together provide evidence that the recipient role of *give*-type verbs comes from the verbs themselves, rather than functional heads or the constructions they occur in.

How can interpretive illusions arise?

- Interpretive illusions can arise due to a failure to enforce the mapping between syntax and semantics, beyond shallow processing of either syntax or semantics taken separately.
- Further research is needed to determine what about the goal extracted sentences makes the syntax/semantics mapping fallible in these cases.

We should seek a model of language that can provide straightforward explanations not only for what happens when parsing goes right, but also for why parsing fails in the ways that it does. In this case, figuring out how illusory parsing behavior arises leads to a conclusion about where thematic roles may reside in the grammar.

Acknowledgements

Many, many thanks to Lyn Frazier and Brian Dillon for their help with all the practical and theoretical aspects of this project, as well as to Jeremy Hartman for serving as chair of my GP committee. Thanks to Rong Yin for many discussions about this project at every stage of its development, to Kyle Johnson for discussions about an earlier stage of this project, to Christopher Hammerly and Brandon Prickett for test-running a version of experiment 2 and providing feedback, to participants of the Fall 2016 UMass psycholinguistics seminar for feedback on a presentation of experiment 1, to attendees of the 2017 UMass Linguistics second-year mini-conference for questions and feedback, and to attendees of psycholinguistics workshop for feedback. And thank you for listening!

References

Beckman, J. N. (1996). Double objects, definiteness, and extraction: A processing perspective. In M. W. Dickey, & S. Tunstall (Eds.) *Linguistics in the Laboratory*, vol. 19 of *University of Massachusetts Occasional Papers in Linguistics*, (pp. 27–70). Amherst, Massachusetts: Graduate Student Linguistics Association.

Bredart, S., & Modolo, K. (1988). Moses strikes again: Focalization effect on a semantic illusion. *Acta Psychologica*, *67*, 135–144.

Drummond, A. (2011). *IbexFarm (Version 0.3.9) [Software]*. Available online at: http://spellout.net/ibexfarm/.

Erickson, T. D., & Mattson, M. E. (1981). From words to meaning: A semantic illusion. *Journal of Verbal Learning and Verbal Behavior*, *20*, 540–551.

Ferreira, F., Bailey, K. G. D., & Ferraro, V. (2002). Good-enough representations in language comprehension. *Current Directions in Psychological Science*, *11*(1), 11–15.

Ferreira, F., & Patson, N. D. (2007). The 'good enough' approach to language comprehension. *Language and Linguistics Compass*, *1*(1–2), 71–83.

Gibson, E., Bergen, L., & Piantadosi, S. T. (2013). Rational integration of noisy evidence and prior semantic expectations in sentence interpretation. *Proceedings of the National Academy of Sciences of the United States of America*, *110*(20), 8051–8056.

Goldberg, A. E. (1995). *Constructions: A Construction Grammar Approach to Argument Structure*. Cognitive Theory of Language and Culture. Chicago, IL: The University of Chicago Press.

Gropen, J., Pinker, S., Hollander, M., Goldberg, R., & Wilson, R. (1989). The learnability and acquisition of the dative alternation in English. *Language*, *65*, 203–257.

Harley, H. (1995). *Subjects, Events and Licensing*. Ph.D. thesis, MIT.

Harley, H. (2003). Possession and the double object construction. In P. Pica, & J. Rooryck (Eds.) *Linguistic Variation Yearbook 2*, (pp. 31–70). Amsterdam: John Benjamins.

Harley, H. (2011). A minimalist approach to argument structure. In *The Oxford Handbook of Linguistic Minimalism*. Oxford University Press. DOI: 10.1093/oxfordhb/9780199579368.013.0019.

Krifka, M. (1999). Manner in dative alternation. In S. Bird, A. Carnie, J. D. Haugen, & P. Norquist (Eds.) *Proceedings of the 18th West Coast Conference on Formal Linguistics*, (pp. 260–271). Cambridge, Massachusetts: Cascadilla Press.

Krifka, M. (2004). Semantic and pragmatic conditions for the dative alternation. *Korean Journal of English Language and Linguistics*, *4*, 1–32.

Levy, R. (2008). A noisy channel model of rational human sentence comprehension under uncertain input. In *Proceedings of the Thirteenth Conference on Empirical Methods in Natural Language Processing*, (pp. 234–243). Stroudsburg, PA: Association for Computational Linguistics.

Levy, R., Bicknell, K., Slattery, T., & Rayner, K. (2009). Eye movement evidence that readers maintain and act on uncertainty about past linguistic input. *Proceedings of the National Academy of Sciences*, *106*(50), 21086–21090.

Lowder, M. W., & Gordon, P. C. (2016). Eye-tracking and corpus-based analyses of syntax-semantics interactions in complement coercion. *Language, Cognition and Neuroscience*, *31*(7), 921–939.

Müller, S., & Wechsler, S. (2014). Lexical approaches to argument structure. *Theoretical Linguistics*, *40*(1–2), 1–76.

Pinker, S. (2007). *The Stuff of Thought: Language as a Window into Human Nature*. New York, New York: Penguin Books.

Rappaport Hovav, M., & Levin, B. (2007). The English dative alternation: The case for verb sensitivity. *Journal of Linguistics*, *44*, 129–167.

Sanford, A. J., & Sturt, P. (2002). Depth of processing in language comprehension. *TRENDS in Cognitive Sciences*, *6*(9), 382–386.

Viau, J. (2006). Give = CAUSE + HAVE/GO: Evidence for early semantic decomposition of dative verbs in English child corpora. In *Proceedings of the 30th Annual Boston University Conference on Language Development*. Cambridge, Massachusetts: Cascadilla Press.

Wechsler, S. (1995). *The Semantic Basis of Argument Structure*. Dissertations in Linguistics. Stanford, CA: CSLI Publications.

Appendix: Goal Extractions Ill-formed?

For each experiment, participants answered a question to determine whether they accepted DO goal extractions following the main experiment (cf. Beckman 1996).

- For the replication of exp. 1, there were no significant effects involving participants' acceptance of DO goal extractions when this was included as a factor. All other effects pattern the same as reported above.

Experiment 2 might be more of a concern, due to the reliance on the ill-formed controls:

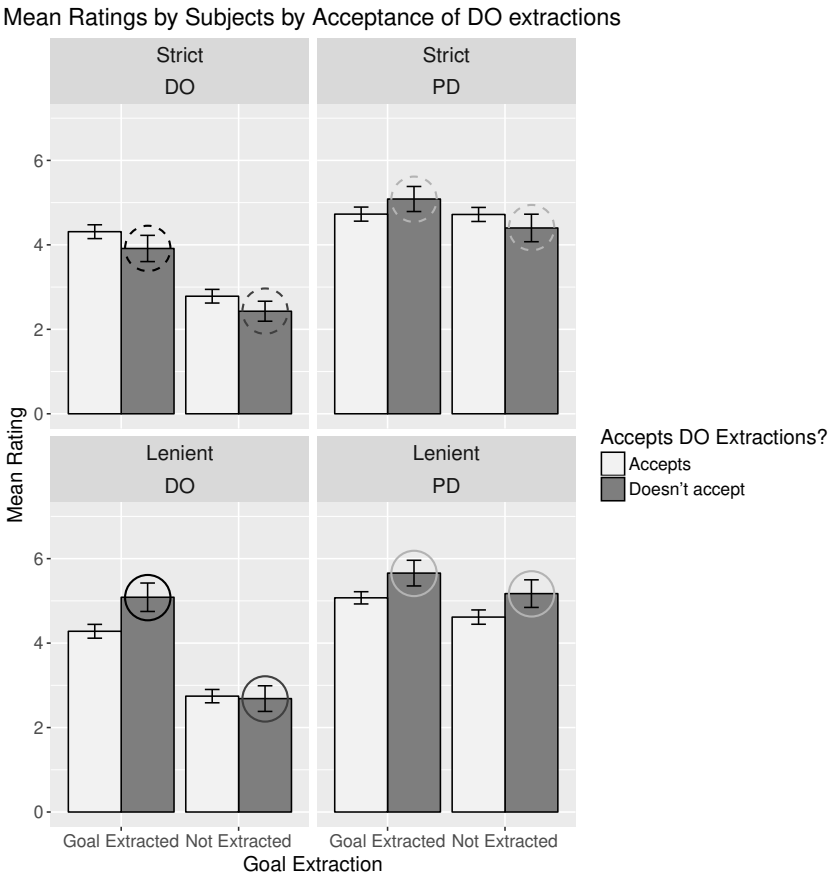
- For accepting participants ($N = 50$), no sentences prior to the ill-formed controls were ill-formed.
- For unaccepting participants ($N = 14$), 5 sentences prior to the ill-formed controls were ill-formed.
- The task context could be affected differently by the ill-formed controls for each group.

There was a marginal interaction of acceptance of DO goal extractions with Instruction Type, Construction, and Goal Extraction ($F_1(1, 60) = 3.71$, $p = 0.06$).

- Unaccepting participants rated DO goal extractions higher in the lenient condition (though they also rated PD sentences of both types higher).
- Accepting participants showed no difference in their ratings for these sentences between the strict and lenient conditions.

Order effects on ill-formed controls are more of a concern for participants who accept DO goal extractions, as they can be explained by a changing task context.

- For participants who accept DO goal extractions, the effect of Instruction Type only shows up by the second ill-formed control overall for missing preposition items.



- Two ill-formed sentences in a row may be enough to change the task context for these speakers, such that the repair mechanisms involved in the ill-formed controls and in experimental items are different.

We still have to explain why goal extraction leads to better ratings for DO goal extractions for unaccepting participants in both instruction conditions.

- Unaccepting participants may be sensitive to instruction type for the experimental items. They are processing material deeply enough to repair it differently depending on instructions.
- However, there is an interaction between Goal Extraction and Construction for both instruction types.
  - Extraction leads to higher ratings in the DO condition. Perhaps extraction causes less thorough processing of the embedded clause.
- But now we must claim that participants are processing the embedded clauses both deeply and shallowly.
  - Deeply: they note and correct for missing prepositions differently depending on instruction type.
  - Shallowly: ...but they don't notice the argument structure mismatch that the missing preposition indicates.
- The improvement in ratings is related to a misprocessing of argument structure above and beyond misprocessing missing prepositions.
  - Missing prepositions are part of what's deeply processed.
  - Argument structure is shallowly processed.
  - This is compatible with the general finding that processing is eased across clause boundaries, but also with the dative illusion not being reducible to this effect.